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| 10/540,132      | 06/21/2005  | Richard E Duren      | 2003US002           | 5375             |

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EXXONMOBIL UPSTREAM RESEARCH COMPANY  
P.O. BOX 2189  
(CORP-URC-SW 337)  
HOUSTON, TX 77252-2189

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| EXAMINER |
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PHILLIPS, FORREST M

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| ART UNIT | PAPER NUMBER |
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2837

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE  | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS                               | 02/14/2007 | PAPER         |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

## Office Action Summary

Application No.

10/540,132

Applicant(s)

DUREN ET AL.

Examiner

Forrest M. Phillips

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 6/12/05
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_

## **DETAILED ACTION**

### ***Claim Objections***

Claims 27 and 28 are objected to because of the following informalities: Claims depend from an apparatus claim but recite "the method of claim 26" the claims will be treated as reading "the apparatus of claim 26". Appropriate correction is required.

Claims 7 and 9 are objected to as the presence of "pressure gradient sensors" seems to contradict the "motion sensor" limitation.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duren (US6678207) in view of Yang (US 4153134).

With respect to claim 1 Duren discloses wherein a reflected up-going wave and a down-going wave combine to form a third down-going wave (Column 9 line 60 to Column 10 line 30).

Duren does not disclose expressly a method of generating the waves.

Yang discloses a marine seismic source method, the method comprising: generating an up-going (not illustrate but necessarily created) and down-going wave with opposite polarity (Column 2 lines 18-35).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the method of generating seismic waves as taught by Yang with the method of combining waves as taught by Duren to provide a means of controlling how the waves are formed.

With respect to claim 11 Duren discloses an up-going wave and a first down-going wave and the first up-going wave has a reverse polarity relative to the first down-going wave wherein the up-going wave becomes a second down-going wave with the same polarity as the first down-going wave after the up-going wave reflects off the surface of the water and the first and second down-going waves combine substantially in-phase to form a third down-going wave.

Duren does not disclose an apparatus comprising a seismic source device wherein at least part of the device is below the surface of the water and the device is adapted to cause oscillations below the surface of the water; or means for causing the oscillations.

Yang discloses a marine seismic source apparatus comprising:

A seismic source device (12 in figure 1) wherein at least part of the device is below the surface of the water and the device is adapted to cause oscillations below the surface of the water; and a means for causing oscillations in the water (expansion of the bag) to create an up going wave and a down-going wave (Column 2 lines 18-35).

Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang as applied to claim 1 above, and further in view of He (US6607050).

With respect to claims 2 and 4 Duren as modified discloses the invention as claimed except further comprising detecting the seismic waves produced from the seismic source with at least one motion sensor, or with both motion sensors and pressure sensors.

He discloses the use of motion sensors (7,8,9 in figure 2) selected from the group of velocity, acceleration, higher derivatives of particle displacement, Doppler shift, pressure gradient and any combination thereof (Column 5 lines 20-40).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of He to use both pressure sensors and motion sensor with the method of Duren in view of Yang to provide signals that contain both pressure information as well as velocity information to gain a greater understanding of the substrate characteristics.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang and He as applied to claim 2 above, and further in view of Galbraith and Millington.

With respect to claim 5 Duren as modified discloses the invention as claimed except further comprising an inversion applied to the recorded seismic data to reduce wavelet uncertainty.

Galbraith and Millington disclose the use of inversion of seismographic data.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Galbraith and Millington to apply an inversion to the data gathered in the method of Duren in view of Yang and He to recover low frequency data.

Claims 3, 12, 15, and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang as applied to claims 1 and 11 above, and further in view of Ambs (US6230840).

With respect to claims 3, 12 and 15 Duren in view of Yang discloses the invention as claimed except wherein the generated waves contain frequencies of less than 10Hz.

Ambs discloses an apparatus and method of producing waves containing frequencies less than 10 Hz (Column 2 lines 1-15).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Ambs to incorporate the frequencies less than 10Hz with the method of Duren as modified to provide the important low frequency data.

With respect to claim 21 Ambs further discloses wherein the device is at least two marine vibrators (12 in figure 1C) comprising at least one upper marine vibrator that vibrates out of phase with at least one lower marine vibrator wherein the upper marine vibrator radiates an up-going wave that has reverse polarity to the first down-going wave that radiates from the lower marine vibrator and the backsides of the vibrators are stationary during operation of the vibrators.

With respect to claim 22 Ambs further discloses wherein the waves contain frequencies of less than 10Hz (column 2 lines 1-15).

With respect to claim 23 Ambs further discloses wherein the backsides of the upper and lower vibrators are connected (see figure 1c).

Claims 13-14, are rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang as applied to claim 11 above, and further in view of Airhart (US49916885).

With respect to claim 13 Duren in view of Yang discloses the invention as claimed except wherein the device is a vibrating baseplate below the surface of the water and the means for causing oscillations in the water is a reaction mass above the ocean surface, the reaction mass housing a piston and a corresponding cylinder, the piston rigidly attached to the baseplate, the piston adapted to oscillate along the axis of the cylinder when activated and means for activating the piston wherein as the vibrating baseplate is pushed down a compression wave is radiated as a down going wave and a rarefraction wave is radiated as an up-going wave, wherein the compression wave is the first down going wave and the rarefraction wave is the up-going wave.

Airhart discloses a vibrating baseplate (76 in figure 2) below the surface of the water and the means for causing oscillations is a reaction mass (30 in figure 2) the reaction mass housing a piston (40 in figure 2) and a corresponding cylinder (38 in figure 2), the piston adapted to oscillate along the axis of the cylinder when activated and means for activating the piston (60 in figure 2) wherein the vibrating baseplate is pushed down a compression wave is radiated as a down-going wave and a rarefraction wave is radiated as an up-going wave.

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radiated as an up-going wave, wherein the compression wave is the first down going wave and the rarefaction wave is the first up-going wave.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Airhart to use a reaction mass and piston cylinder arrangement for the apparatus of Duren as modified to provide an effective means of creating low frequencies.

Duren as modified discloses the invention as claimed except wherein the piston is rigidly attached to the baseplate. It would have been obvious to one of ordinary skill in the art to attach the piston to the baseplate as it has been held that rearranging the parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

With respect to claim 14 Airhart further discloses wherein the means for activating the piston is a hydraulic system with fluid pressure from valves connected to the cylinder (Column 3 lines 30-40).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang as applied to claim 11 above, and further in view of Reed (US4016952).

With respect to claim 24 Duren in view of Yang discloses the invention as claimed except wherein the device is a rigid plate which serves as reaction mass and back plane below the surface of the water and the means of causing oscillations in the water is at least one piston and at least one corresponding cylinder through the plate and oriented normal to the large surfaces of the plate, the piston pushing directly on the water, the piston adapted to oscillate along the axis of the cylinder when activated and means for activating the piston wherein as at least one piston is pushed down a



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compression wave is radiated as a down going wave and a rarefraction wave is radiated as an up-going wave wherein the compression wave is the first down-going wave and the rarefraction is the up-going wave.

Reed discloses the use of a rigid plate (58 in figure 2) which serves as reaction mass and back plane below the surface of the water and the means of causing oscillations in the water is at least one piston (56 in figure 2) and at least one corresponding cylinder (51 in figure 2) through the plate and oriented normal to the large surfaces of the plat, the piston pushing directly on the water, the piston adapted to oscillate along the axis of the cylinder when activated and means for activating the piston wherein as at least one piston is pushed down a compression wave is radiated as a down going wave and a rarefraction wave is radiated as an up-going wave wherein the compression wave is the first down-going wave and the rarefraction is the up-going wave (Column 4 lines 45-50).

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang and Reed as applied to claim 24 above, and further in view of Ambs.

With respect to claim 25 <sup>Duren</sup>~~Duren~~ as modified discloses the invention as claimed except wherein the first down-going and the third down-going waves contain frequencies of less than 10Hz.

Ambs discloses the use of a an apparatus for creating seismic waves containing frequencies of less than 10 Hz (Column 2 lines 1-15).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Ambs to generate waves having frequencies

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including 10Hz with the device of Duren as modified to provide a the important low frequency data.

Claims 16-17,19 rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang as applied to claim 11 above, and further in view of Myers (US4853905).

With respect to claim 16 Duren in view of Yang discloses wherein the device is a flexible membrane below the surface of the water and the means for causing oscillations in the water is a supporting frame connected to the membrane, the supporting frame (12 in figure 1) containing at least one drive mechanism adapted to oscillate the membrane thereby generating an up-going wave from the membrane that has reverse polarity to the first down-going wave generated form the membrane.

Duren in view of Yang does not disclose two flexible membranes, an upper and a lower.

Myres discloses an upper (12,14 in figure 1) and lower (12,16 in figure 1) membrane for creating acoustic weaves (abstract) and a driving mechanism (20 in figure 1).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Myers to use two membrane with the apparatus of Duren as modified to provide a structure that would more generate primarily up going and down going waves.

With respect to claim 17 Myers discloses the use of a hydraulic system (20 is a hydraulic cylinder), Yang discloses the use of a pneumatic system (refer to figure 1).

With respect to claim 19 Yang discloses wherein the device is a flexible membrane below the surface of the water and the means for creating oscillations in the water is a rigid frame (12 in figure 1), the rigid frame adapted to controllably permit air flow within the membrane and the membrane adapted to expand when air enters the membrane and contract when air exits the membrane wherein an up-going wave is formed from the upper portion of the membrane that has a reverse polarity to the first down-going wave from the lower portion of the membrane that is operating out of phase with the upper portion of the membrane.

Myers discloses the use of two membranes, an upper (12,14 in figure 1) and a lower (12,16 in figure 1) operating out of phase with one another .

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Myers to use dual membranes with the structure of Yang to provide a structure that would more generate primarily up going and down going waves.

Claims 18 and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Duren in view of Yang and Myers as applied to claims 16 and 19 above, and further in view of Ambbs.

With respect to claims 18 and 20 Duren in view of Yang and Myers discloses the invention as claimed except wherein the first down-going and the third-down going waves contain frequencies of less than 10 Hz.

Ambbs discloses the use of an apparatus for creating seismic waves containing frequencies of less than 10 Hz (Column 2 lines 1-15).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Ambros to generate waves having frequencies including 10Hz with the device of Duren as modified to provide the important low frequency data.

Claims 6, 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barber, Sr. (US6091668).

With respect to claim 26 Barber discloses a marine seismic source apparatus comprising:

A seismic source device (3 in figure 1A) wherein at least part of the device is below the surface of the water and the device creates an up going wave and a first down going wave, wherein the up going wave is substantially near the surface of the water and has enough energy to break through the surface of the water into the atmosphere wherein there is no significant wave reflected off the surface of the water and the first down going wave is the only significant down-going wave produced by the source (Column 6 lines 25-35).

While it is not expressly stated in Barber that the wave breaks through to the atmosphere due to the large amount of energy it contains it would have been understood by one of ordinary skill in the art that this was the case.

With respect to claim 27 Barber expressly discloses wherein the source is an air gun (Column 4 lines 50-55). Implicit in the teachings are that the air pocket is blown out of the water (Column 6 lines 25-35), as would have been understood by one of ordinary skill in the art.

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With respect to claim 6 The method of claim 6 is necessitated by the apparatus of Barber.

With respect to claims 7 and 9 Barber discloses the use of hydrophones (4 in figure 1A), as hydrophones are capable of detecting pressure gradients examiner considers them as functioning as motion sensors given the current claim structure.

Claims 8 and 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barber as applied to claim 26 above, and further in view of Ambs (US6230840).

Barber discloses the invention as claimed except for expressly that the first down going wave contains frequencies of less than 10 Hz.

Ambs discloses that this frequency range is typical of airguns (Column 1 lines 30-31).

At the time of the invention it would have been obvious to one of ordinary skill in the art that the range would be included in the source of Barber as explicitly stated by Ambs.

Alternatively Claims 7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barber as applied to claim 6 above, and further in view of He (US6607050).

With respect to claims and 7 and 9 Barber further discloses further comprising detecting seismic waves produced by the seismic source with pressure sensors (4 in figure 1A).

Barber does not disclose the use of motion sensors.

He discloses the use of motion sensors (7,8,9 in figure 2) selected from the group of velocity, acceleration, higher derivatives of particle displacement, Doppler shift, pressure gradient and any combination thereof (Column 5 lines 20-40).

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of He to use both pressure sensors and motion sensor with the method of Barber to provide signals that contain both pressure information as well as velocity information to gain a greater understanding of the substrate characteristics.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barber in view of He as applied to claim 7 above, and further in view of Galbraith and Millington.

Barber in view of He discloses the invention as claimed except wherein an inversion is applied to the recorded seismic data to reduce wavelet uncertainty.

Galbraith and Millington disclose the use of inversion of seismographic data.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the teachings of Galbraith and Millington to apply an inversion to the data gathered in the method of Barber in view of He to recover low frequency data.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Listed on form 892.

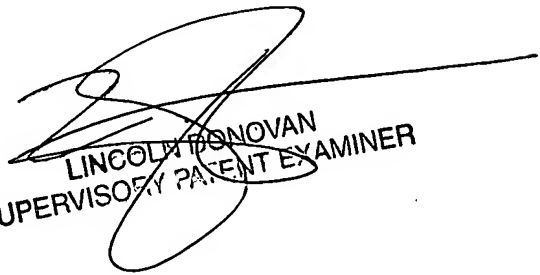
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Forrest M. Phillips whose telephone number is 5712729020. The examiner can normally be reached on Monday through Friday 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lincoln Donovan can be reached on 5712721988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FP

  
LINCOLN DONOVAN  
SUPERVISORY PATENT EXAMINER